We claim:

1. A method for segmenting an image formed by a plurality of pixels using a region-merging process characterised by using covariance data and a plurality of vector components of each said pixel to evaluate a merging criterion for regions of said image.

2. A method according to claim 1 wherein said plurality of vector components comprise at least two of colour, range and motion.

3. A method according to claim 2 wherein said colour vector component comprises at least one colour channel of a colour space in which said image can be reproduced.

4. A method for segmenting an image formed by a plurality of pixels, each said pixel being described by a vector having components each relating to a different measured image characteristic, said method comprising the steps of:

(a) receiving, for each said pixel, a plurality of said vector components and a corresponding error covariance representation of said pixel;

(b) for each said pixel, fitting each said component and the corresponding covariance representation to a predetermined linear model to obtain a set of model parameters and corresponding confidence representations;

(c) statistically analysing the sets of model parameters and corresponding confidence representations to derive a segmentation of said image that minimises a predetermined cost function.

5. A method according to claim 4 wherein step (c) comprises the sub-steps of:

(ca) defining said pixels to each be initial regions of said image;

(cb) merging said regions in a statistical order using said sets of model parameters and confidence representations to obtain a null segmentation of said image;

(cc) analysing a curve formed using said model parameters and corresponding confidence representations to determine an optimal halting criterion at which to cease the merging of said regions; and

(cd) processing said merging of said initial regions to halt when said optimal merging criterion is reached.

6. A method according to claim 5 wherein sub-step (cd) comprises re-executing the entire merge of said initial regions using said model parameters and confidence representations to provide said merged segmentation.

7. A method according to claim 5 wherein sub-step (cc) comprises identifying returns to monotonicity from local minima in said curve and selecting a predetermined said return approaching the null segmentation as said optimal halting criterion.

8. A method according to claim 7 wherein step (cd) comprises re-executing the merge of said regions using said model parameters up until said predetermined return is reached to provide said merged segmentation.

9. A method according to claim 5 wherein said statistical order is determined using an order of minimum covariance-normalised vector distance between adjacent regions of said segmentation.

10. A method according to claim 5 wherein said statistical order is determined using a length of a common boundary between adjacent regions.

11. A method according to claim 5 wherein said statistical order is determined by dividing a minimum covariance-normalised vector distance between adjacent regions of said segmentation by a length of a common boundary between adjacent regions, and ordering the resulting quotients.

12. A method according to claim 11 wherein each said quotient forms a test statistic, a record of which is retained at each merging step.

13. A method according to claim 4, wherein said plurality of vector components comprise at least two of colour, range and motion.

14. A method according to claim 5, wherein said colour vector component comprises at least one colour channel of a colour space in which said image can be reproduced.

15. A method for unsupervised selection of a stopping point for a region-merging segmentation process, said method comprising the steps of:

(a) analysing a graph of merging cost values to identify departures from substantial monotonicity of said graph; and

(b) selecting said stopping point to be a merging cost value corresponding to a return to monotonicity of said graph, said selected stopping point being associated with one of a limited plurality of final said departures in said region merging process.

16. A method according to claim 15 wherein said selected stopping point comprises a return from said final departure.

17. A method according to claim 15 wherein said departures are larger than a predetermined threshold.

18. A method according to claim 15 wherein said merging cost function comprises an ordered series of test statistics, each said test statistic being formed, for each adjacent pair of regions in the segmented image, by dividing a covariance-normalised vector distance between the pair by a length of a common boundary between the pair.

19. Apparatus for segmenting an image formed by a plurality of pixels using a region-merging process characterised by using covariance data and a plurality of vector components of each said pixel to evaluate a merging criterion for regions of said image.

20. Apparatus according to claim 19 wherein said plurality of vector components comprise at least two of colour, range and motion.

21. Apparatus according to claim 20 wherein said colour vector component comprises at least one colour channel of a colour space in which said image can be reproduced.

22. Apparatus for segmenting an image formed by a plurality of pixels, each said pixel being described by a vector having components each relating to a different measured image characteristic, said apparatus comprising:

means for receiving, for each said pixel, a plurality of said vector components and a corresponding error covariance representation of said pixel;

means for fitting, for each said pixel, each said component and the corresponding covariance representation to a predetermined linear model to obtain a set of model parameters and corresponding confidence representations; and

analysing means for statistically analysing the sets of model parameters and corresponding confidence representations to derive a segmentation of said image that minimises a predetermined cost function.

23. Apparatus according to claim 22 wherein said analysing means comprises:

defining means for defining said pixels to each be initial regions of said image;

merging means for merging said regions in a statistical order using said sets of model parameters and confidence representations to obtain a null segmentation of said image;

curve analysing means for analysing a curve formed using said model parameters and corresponding confidence representations to determine an optimal halting criterion at which to cease the merging of said regions; and

processing means for processing said merging of said initial regions to halt when said optimal merging criterion is reached.

24. Apparatus according to claim 23 wherein said processing means comprises means for re-executing the entire merge of said initial regions using said model parameters and confidence representations to provide said merged segmentation.

25. Apparatus according to claim 23 wherein said curve analysing means comprises means for identifying returns to monotonicity from local minima in said curve and means for selecting a predetermined said return approaching the null segmentation as said optimal halting criterion.

26. Apparatus according to claim 25 wherein said processing means comprises means for re-executing the merge of said regions using said model parameters up until said predetermined return is reached to provide said merged segmentation.

27. Apparatus according to claim 23 wherein said statistical order is determined using an order of minimum covariance-normalised vector distance between adjacent regions of said segmentation.

28. Apparatus according to claim 23 wherein said statistical order is determined using a length of a common boundary between adjacent regions.

29. Apparatus according to claim 23 wherein said statistical order is determined by dividing a minimum covariance-normalised vector distance between adjacent regions of said segmentation by a length of a common boundary between adjacent regions, and ordering the resulting quotients.

30. Apparatus according to claim 29 wherein each said quotient forms a test statistic, a record of which is retained at each merging.

31. Apparatus according to claim 22, wherein said plurality of vector components comprise at least two of colour, range and motion.

32. Apparatus according to claim 23, wherein said colour vector component comprises at least one colour channel of a colour space in which said image can be reproduced.

33. Apparatus for unsupervised selection of a stopping point for a region-merging segmentation process, said apparatus comprising:

means for analysing a graph of merging cost values to identify departures from substantial monotonicity of said graph; and

means for selecting said stopping point to be a merging cost value corresponding to a return to monotonicity of said graph, said selected stopping point being associated with one of a limited plurality of final said departures in said region merging process.

34. Apparatus according to claim 33 wherein said selected stopping point comprises a return from said final departure.

35. Apparatus according to claim 33 wherein said departures are larger than a predetermined threshold.

36. Apparatus according to claim 33 wherein said merging cost function comprises an ordered series of test statistics, each said test statistic being formed, for each adjacent pair of regions in the segmented image, by dividing a covariance-normalised vector distance between the pair by a length of a common boundary between the pair.

37. A program for making a computer execute a procedure to segment an image formed by a plurality of pixels using a region-merging process characterised by using covariance data and a plurality of vector components of each said pixel to evaluate a merging criterion for regions of said image.

38. A program according to claim 37 wherein said plurality of vector components comprise at least two of colour, range and motion.

39. A program according to claim 38 wherein said colour vector component comprises at least one colour channel of a colour space in which said image can be reproduced.

40. A program for making a computer execute a procedure to segment an image formed by a plurality of pixels, each said pixel being described by a vector having components each relating to a different measured image characteristic, said program comprising:

code for receiving, for each said pixel, a plurality of said vector components and a corresponding error covariance representation of said pixel;

code for, for each said pixel, fitting each said component and the corresponding covariance representation to a predetermined linear model to obtain a set of model parameters and corresponding confidence representations; and

analysing code for statistically analysing the sets of model parameters and corresponding confidence representations to derive a segmentation of said image that minimises a predetermined cost function.

41. A program according to claim 40 wherein said analysing code comprises:

code for defining said pixels to each be initial regions of said image;

code for merging said regions in a statistical order using said sets of model parameters and confidence representations to obtain a null segmentation of said image;

code for analysing a curve formed using said model parameters and corresponding confidence representations to determine an optimal halting criterion at which to cease the merging of said regions; and

code for processing said merging of said initial regions to halt when said optimal merging criterion is reached.

42. A program for making a computer execute a procedure for unsupervised selection of a stopping point for a region-merging segmentation process, said program comprising:

code for analysing a graph of merging cost values to identify departures from substantial monotonicity of said graph; and

code for selecting said stopping point to be a merging cost value corresponding to a return to monotonicity of said graph, said selected stopping point being associated with one of a limited plurality of final said departures in said region merging process.

43. A program according to claim 42 wherein said selected stopping point comprises a return from said final departure.

44. A program according to claim 43 wherein said departures are larger than a predetermined threshold.

45. A program according to claim 42 wherein said merging cost function comprises an ordered series of test statistics, each said test statistic being formed, for each adjacent pair of regions in the segmented image, by dividing a covariance-normalised vector distance between the pair by a length of a common boundary between the pair.